



US006824064B2

(12) **United States Patent**
Guthery et al.

(10) **Patent No.:** **US 6,824,064 B2**
(45) **Date of Patent:** **Nov. 30, 2004**

(54) **CONCURRENT COMMUNICATION WITH MULTIPLE APPLICATIONS ON A SMART CARD**

WO WO 01/16873 A1 1/2000
WO WO 01/16874 A1 1/2000

(List continued on next page.)

(75) Inventors: **Scott Bates Guthery**, Newton, MA (US); **Mary Joanne Kiernan Cronin**, Newton, MA (US)

OTHER PUBLICATIONS

“Part III —Application Section,” *EMV '96 Integrated Circuit Card Specification for Payment Systems*, Version 3.1.1, May 31, 1998.

(73) Assignee: **Mobile-Mind, Inc.**, Watertown, MA (US)

International Standard, “Information technology —Identification cards —Integrated circuit(s) with contacts —Part 4: Interindustry commands for interchange,” *ISO/IEC 7816-4*, (1995).

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 286 days.

Global System for Mobile Communications, “Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module —Mobile Equipment (SIM —ME) interface,” *GSM 11.14 version 8.2.0*, Release 1999.

(List continued on next page.)

(21) Appl. No.: **09/730,670**

(22) Filed: **Dec. 6, 2000**

(65) **Prior Publication Data**

US 2002/0066792 A1 Jun. 6, 2002

(51) **Int. Cl.**⁷ **G06K 19/06**

(52) **U.S. Cl.** **235/492; 235/375; 235/380; 235/382; 361/737; 711/102; 711/103; 710/102; 710/301**

(58) **Field of Search** **235/492, 380, 235/382, 486, 379; 361/737; 711/102, 103; 710/102, 301**

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,412,382 A 11/1968 Couleur et al.
3,825,904 A 7/1974 Burk et al.
4,442,484 A 4/1984 Childs, Jr. et al. 364/200

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

EP 1 179 780 A1 2/2002
EP 1 331 565 A1 7/2002
EP 1 331 565 A1 7/2003
WO WO 97/50063 12/1997
WO WO 01/16707 A1 1/2000
WO WO 01/16759 A1 1/2000
WO WO 01/16865 A1 1/2000

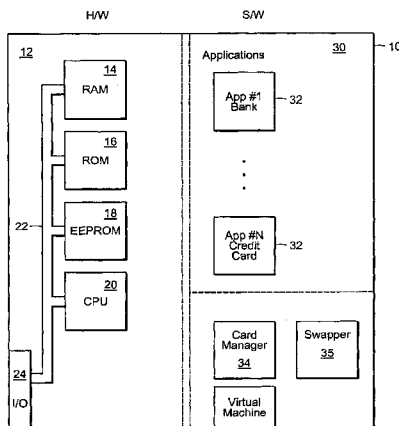
Primary Examiner—Michael G. Lee
Assistant Examiner—Ahshik Kim

(74) *Attorney, Agent, or Firm*—Gesmer Updegrove LLP

(57) **ABSTRACT**

A smart card capable of having a plurality of applications has a memory that is logically partitioned into a plurality of memory blocks. A control program allocates one or more blocks to one of the applications, upon a declaration from the application of its memory needs, and schedules the applications for execution. Only those applications whose memory needs have been satisfied are scheduled. The control program receives a permission request packet from a host, addressed to an application, and passes the permission request packet to the application. When the control program receives a permission packet from the addressed application after the addressed application has had its declared memory needs satisfied, the control program sends the permission packet to the host. A virtual machine is used to execute one or more of the applications. The control program communicates with the virtual machine to control scheduling to predetermined time granularity. A swapper swaps data pages between the smart card's memory, i.e., primary storage, and secondary storage in a host.

7 Claims, 33 Drawing Sheets



U.S. PATENT DOCUMENTS

| | | | | |
|-----------|------|---------|---------------------|---------|
| 4,685,125 | A | 8/1987 | Zave | |
| 4,718,061 | A | 1/1988 | Turner | 370/89 |
| 4,774,659 | A | 9/1988 | Smith et al. | 364/200 |
| 4,868,376 | A | 9/1989 | Lessin et al. | |
| 4,972,338 | A | 11/1990 | Crawford et al. | 364/200 |
| 5,204,965 | A | 4/1993 | Guthery et al. | 395/800 |
| 5,613,073 | A | 3/1997 | Hammond, Jr. et al. | 395/250 |
| 5,729,717 | A * | 3/1998 | Tamada et al. | 395/491 |
| 5,860,083 | A * | 1/1999 | Sukegawa | 711/103 |
| 5,912,453 | A * | 6/1999 | Gungl et al. | 235/492 |
| 5,923,884 | A | 7/1999 | Peyret et al. | 395/712 |
| 5,969,318 | A | 10/1999 | Mackenthun | 235/380 |
| 6,003,134 | A | 12/1999 | Kuo et al. | |
| 6,005,942 | A | 12/1999 | Chan et al. | 380/25 |
| 6,029,892 | A * | 2/2000 | Miyake | 235/380 |
| 6,032,137 | A * | 2/2000 | Ballard | 705/75 |
| 6,038,551 | A | 3/2000 | Barlow et al. | 705/41 |
| 6,052,690 | A | 4/2000 | de Jong | 707/101 |
| 6,081,665 | A | 6/2000 | Nilsen et al. | |
| 6,095,412 | A * | 8/2000 | Bertina et al. | 235/380 |
| 6,145,080 | A * | 11/2000 | Hanel | 713/200 |
| 6,186,677 | B1 | 2/2001 | Angel et al. | |
| 6,216,204 | B1 * | 4/2001 | Thiriet | 711/115 |
| 6,220,510 | B1 * | 4/2001 | Everett et al. | 235/380 |
| 6,250,557 | B1 * | 6/2001 | Forslund et al. | 235/492 |
| 6,256,690 | B1 * | 7/2001 | Carper | 710/102 |
| 6,273,335 | B1 * | 8/2001 | Sloan | 235/382 |
| 6,296,191 | B1 * | 10/2001 | Hamann et al. | 235/492 |
| 6,317,832 | B1 * | 11/2001 | Everett et al. | 713/372 |
| 6,374,286 | B1 | 4/2002 | Gee et al. | |
| 6,390,374 | B1 | 5/2002 | Carper et al. | 235/492 |
| 6,415,160 | B1 | 7/2002 | Wichmann | 455/558 |
| 6,438,573 | B1 | 8/2002 | Nilsen | |
| 6,480,935 | B1 * | 11/2002 | Carper et al. | 711/115 |
| 6,510,498 | B1 | 1/2003 | Holzle et al. | |

| | | | | |
|--------------|------|--------|--------------------|---------|
| 6,526,462 | B1 | 2/2003 | Elabd | |
| 6,564,995 | B1 * | 5/2003 | Montgomery | 235/379 |
| 2002/0095661 | A1 | 7/2002 | Angel et al. | |
| 2002/0099871 | A1 | 7/2002 | Vargas et al. | 709/328 |
| 2003/0037089 | A1 | 2/2003 | Cota-Robles et al. | |
| 2003/0041244 | A1 | 2/2003 | Buttayan et al. | |
| 2003/0046365 | A1 | 3/2003 | Pfister et al. | |
| 2003/0065676 | A1 | 4/2003 | Gbadegesin et al. | |

FOREIGN PATENT DOCUMENTS

| | | |
|----|-----------------|--------|
| WO | WO 00/07153 | 2/2000 |
| WO | WO 00/46709 | 8/2000 |
| WO | WO 00/56030 | 9/2000 |
| WO | WO 02/08897 A1 | 1/2002 |
| WO | WO 02/10889 A2 | 2/2002 |
| WO | WO 02/10918 A1 | 2/2002 |
| WO | WO 02/25976 A1 | 3/2002 |
| WO | WO 02/056174 A2 | 7/2002 |
| WO | WO 03/007105 A2 | 1/2003 |
| WO | WO 03/017125 A1 | 2/2003 |

OTHER PUBLICATIONS

Guthery, S., Self-Timing Programs and the Quantum Scheduler, Communications of the ACM, Jun. 1988.
 Guthery, Scott B.; "Planned Preemption Scheduling of Light-Weight Processes in a Time-Shared Environment." Abstracts Of The IEEE Computer Society —Third Workshop On Real-Time Operating Systems, Boston, Massachusetts; IEEE Computer Society, Feb. 28, 1986.
 Hypponen, Konstantin et al.; "Trading-Off Type-Inference Memory Complexity Against Communication." The Fifth International Conference on Information and Communication Security, Huhhot, Mongolia, Oct. 2003.

* cited by examiner

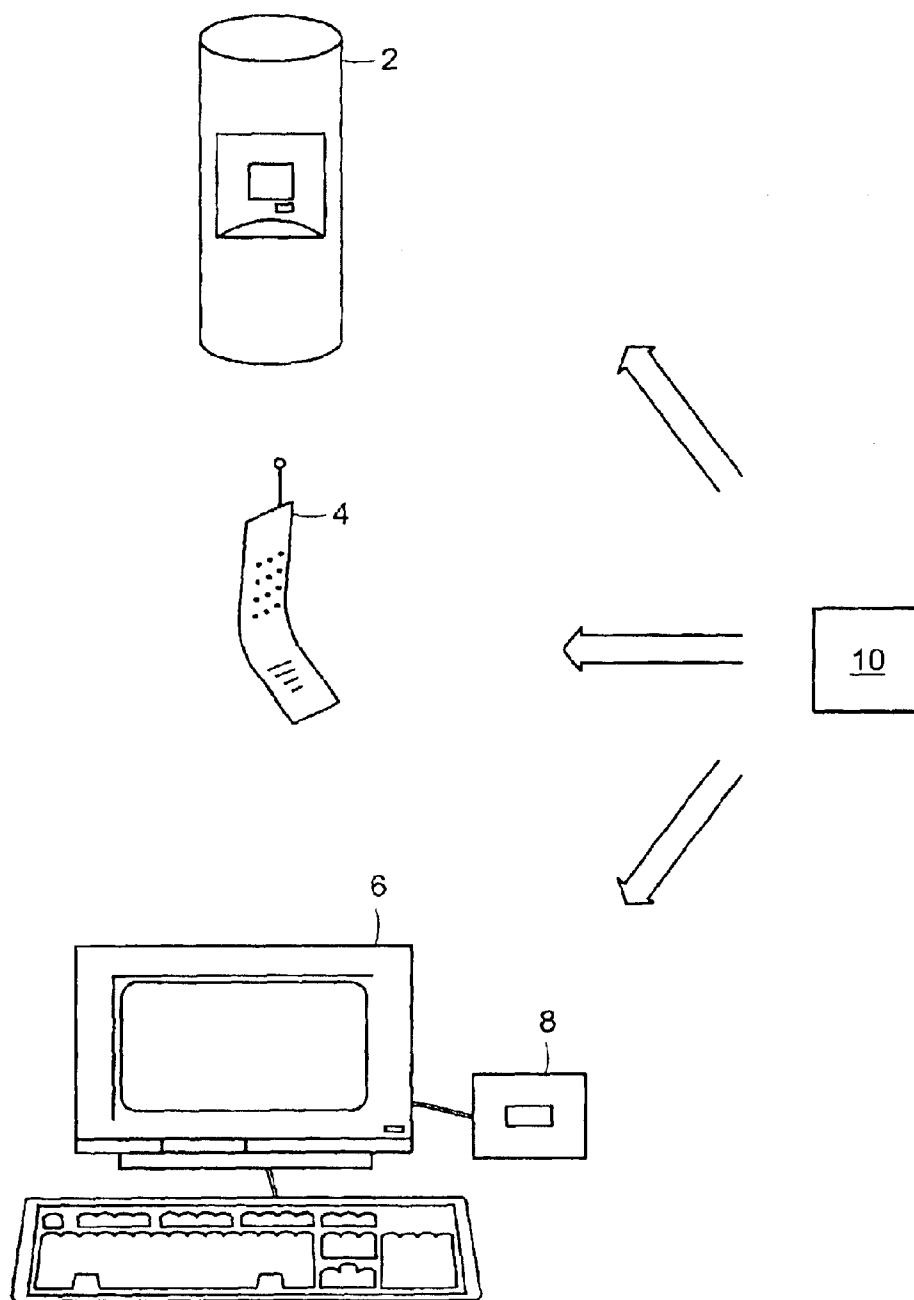


FIG. 1

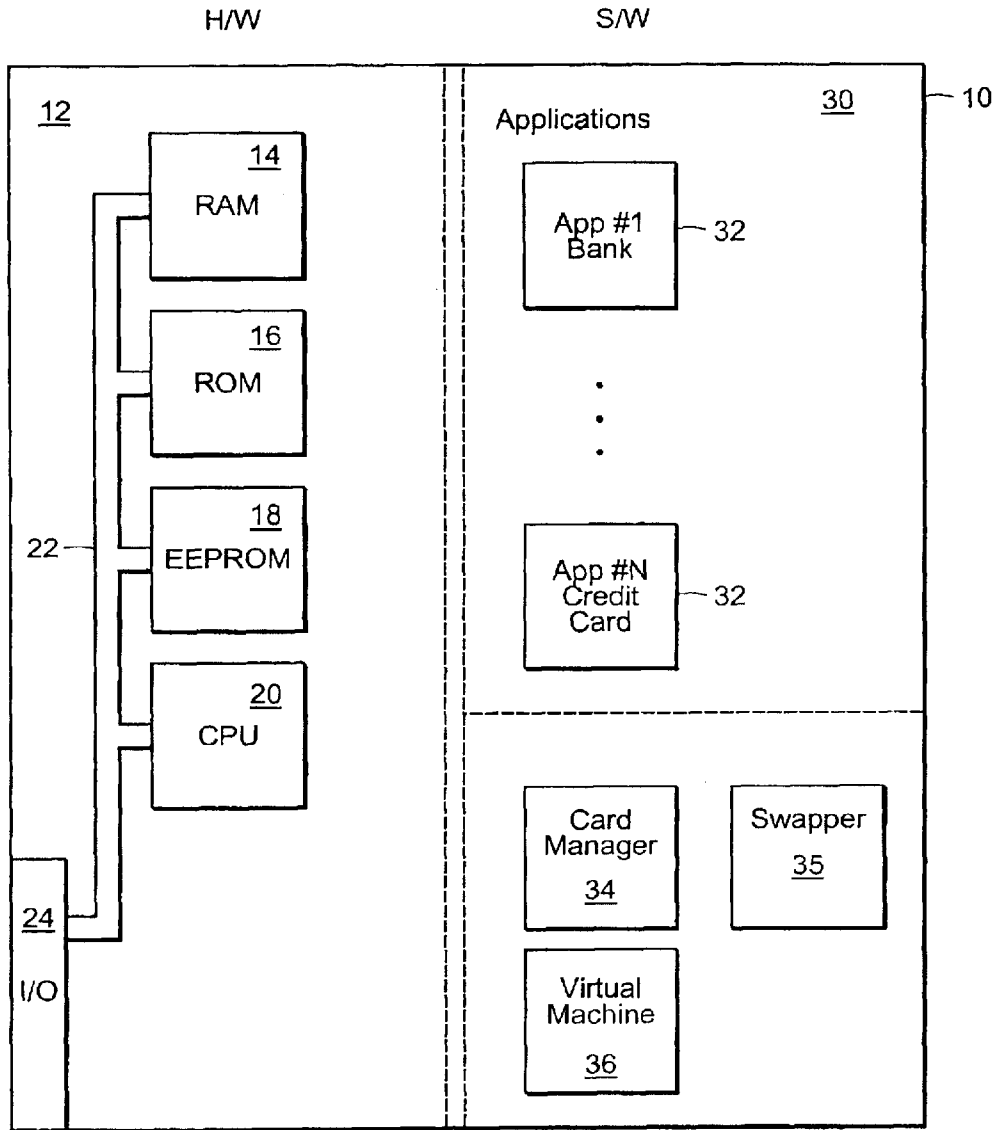


FIG. 2

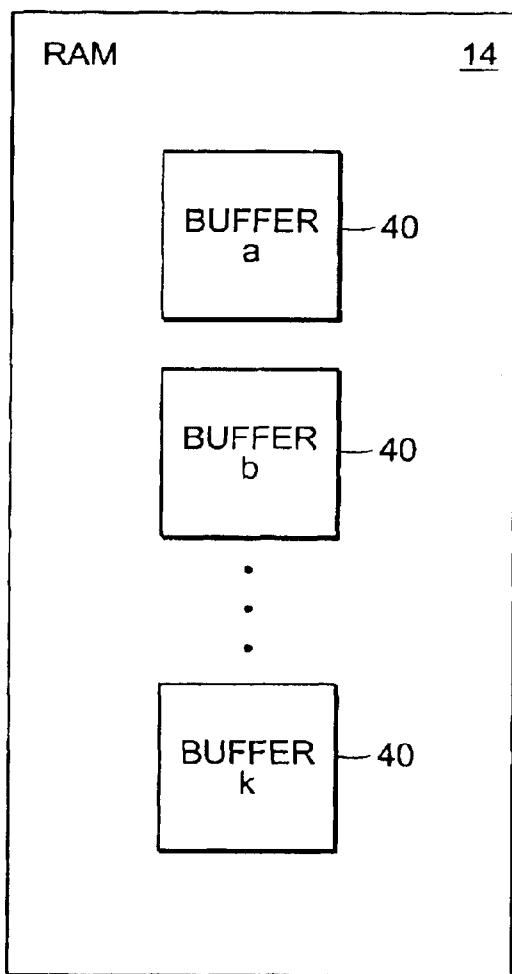


FIG. 3

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.